



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷: B60R 25/04, 25/10	A1	(11) International Publication Number: WO 00/17021 (43) International Publication Date: 30 March 2000 (30.03.00)
(21) International Application Number: PCT/ZA99/00092 (22) International Filing Date: 17 September 1999 (17.09.99) (30) Priority Data: 98/8696 23 September 1998 (23.09.98) ZA (71)(72) Applicant and Inventor: VAN BERGEN, Johannes, Cornelis [ZA/ZA]; 365 Bush Street, Willowpark Manor, P.O. Box 74158, Lynnwoodridge 0040 Pretoria (ZA). (72) Inventor; and (75) Inventor/Applicant (for US only): CILLIERS, Petrus, Johannes [ZA/ZA]; 230 Roos Street, Meyerspark, 0184 Pretoria (ZA).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: ALARM AND IMMOBILISER WITH GSM CELLULAR PHONE <div data-bbox="545 1173 1153 1524" data-label="Diagram"> <p>The diagram illustrates the CELL-EYE system architecture. At the top center is a vertical tower. Four arrows point from this tower to four different components: 1. A car labeled 'VEHICLE EQUIPPED WITH CELL-EYE SYSTEM' (labeled 2). 2. A house labeled 'PROPERTY EQUIPPED WITH CELL-EYE SYSTEM' (labeled 1). 3. A small square labeled 'GSM REPEATER' (labeled 3). 4. A mobile phone labeled 'REMOTE GSM CELL-PHONE' (labeled 4).</p> </div> (57) Abstract <p>A security system called CELL-EYE is disclosed. The system is designed for protecting specific property, human life and the prevention of vehicle-theft and irregular and willful intrusion of property through the detection and automatic reporting of security violations to a specific GSM mobile unit via the DATA and SMS service of the GSM mobile telephone network. The CELL-EYE system includes a controller and memory unit for the verification of the identity of incoming calls, and the activation, deactivation and programming of the CELL-EYE via validated incoming calls received by an alarm linked GSM mobile unit and modem from a remote GSM mobile unit. When activated the controller performs a mode 1 alarm procedure which monitors the alarm outputs of a vehicle or property security system via an alarm sensing interface. When an alarm is detected, the controller automatically places an outgoing call to a designated remote GSM mobile unit and indicates the nature of the alarm via a GSM SMS message. The CELL-EYE controller also includes a program to perform a mode 2 localization procedure which automatically reports the location of the GSM repeater station nearest to the CELL-EYE GSM unit to a remote GSM mobile unit via a GSM SMS message when the CELL-EYE is remotely programmed to do so, thus facilitating the localization and tracking of a stolen vehicle equipped with a CELL-EYE system. The CELL-EYE also includes a vehicle immobilizer and protection interface for performing a mode 3 procedure upon the reception of an incoming call to the vehicle-installed GSM mobile unit. A mode 3 procedure activates the immobilizer systems in a stolen vehicle to facilitate the rapid recovery of the vehicle.</p>		

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ALARM AND IMMOBILISER WITH GSM CELLULAR PHONE

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to vehicle and property security and alarm equipment, vehicle tracking equipment and stolen vehicle recovery equipment. More specifically, the present invention relates to a system to interface conventional vehicle and property security and alarm equipment and vehicle immobilization equipment to a linked GSM mobile telephone system to detect alarms, to report such alarms to the owner or security service provider, to report the location of a vehicle to the owner or security service provider and to remotely activate conventional immobilization equipment installed in a vehicle.

BACKGROUND TO THE INVENTION

Residential housebreaking and vehicle theft are among the five most frequently occurring crimes. An increasing number of residential property owners possess security systems for the detection of irregular or willful intrusion linked to audible alarm systems for alerting others to a potential crime. An increasing number of vehicle owners possess vehicles equipped with intrusion detection systems and vehicle immobilization systems aimed at reducing the incidence of vehicle theft or hijacking or theft from motor vehicles. Most housebreakings, vehicle thefts and hijacks occur in metropolitan areas and along highways. Most stolen and hijacked vehicles are removed to particular locations along known metropolitan routes. Vehicle and property insurance rates are generally increasing. The number of users of cellular mobile telephone systems are also daily expanding. Most metropolitan areas and highways are serviced by the GSM mobile cellular phone network. The proliferation of GSM cell-phone users and the proliferation of conventional alarm systems without a direct link to the owner or to a security service provider, presents an opportunity for linking the two systems via a dedicated and integrated controller integrated with an installed GSM cell-phone system which permits two-way communication between the owner or security service provider and an unattended cell-phone unit installed in a vehicle or property.

Alarm notification and reporting systems which use conventional telephone lines are available for use in connection with residential property and other buildings. Such systems provide for automatic calls to a security service provider when a security violation has occurred. Such systems can be rendered useless when the phone lines are cut or when the conventional phone system is not functional. The reliability of such building-installed alarm systems can be enhanced by means of an unattended GSM cellular phone equipped with an automatic call initiating controller.

Sophisticated vehicle tracking systems are available for use in stolen vehicle recovery systems and fleet management systems which use a Global Positioning Satellite System (GPS) device installed in the vehicle to pinpoint the vehicle location. Such systems also require a dedicated radio communication system to report the vehicle location to the tracking service, often via satellite communication system. Such systems require the involvement of a security service provider which is equipped with appropriate mobile reception equipment and vehicle location display equipment in order to process the GPS data. There is a need for a low cost vehicle tracking system which uses the GSM mobile phone network and which permits the owner to take control of the action following a vehicle theft or hijack or to make use of any security service provider equipped with a GSM mobile phone in assisting him to take action following an alarm, theft or hijack.

By the remote activation of vehicle immobilization systems including fuel starvation valves and interruption of current to the ignition system, stolen vehicles can be immobilized by the use of a GSM cell-phone before such vehicles reach inaccessible or high risk areas and thus the rapid recovery of such vehicles can be facilitated.

SUMMARY OF THE INVENTION

Owner controlled security: The invention called a CELL-EYE system relates to an owner controlled remote alerting device comprising a method of and apparatus for using the GSM cellular phone network to send a message to the owner of a vehicle equipped with a CELL-EYE device or to the owner of a property equipped with such a device or to a designated security service provider in order to alert such owner or security provider of an attempted intrusion of the property, or attempted theft of a vehicle or of attempted theft from a vehicle.

Elements of the system: The CELL-EYE system comprises an installed battery operated GSM mobile unit which will be referred to as the Alarm Linked Unit (ALU). The ALU is linked with a controller and memory unit which in turn is linked with a vehicle security system or a property security system and its alarms via appropriate interfaces. The interfaces of said CELL-EYE system comprises an alarm sensing interface and

a controller with signalling means for generating an outgoing call and a SMS message from the installed GSM mobile unit to a remote GSM cellular phone in response to a number of alarm conditions which correspond to irregular or willful disturbance of the vehicle or property, and an immobilizer/protection interface to activate a vehicle immobilizer or protection unit when an instruction for such action is received via an incoming call to the installed GSM mobile unit.

Purpose of the CELL-EYE: It is the purpose of the said CELL-EYE system to assist the owner or security service provider to protect specific property, human life, and to prevent any criminal intervention thereon, to reduce the likelihood of successful housebreaking, to assist owners, security service providers and police departments in recovering stolen vehicles, to assist security service providers and police departments in apprehending criminals and to reduce insurance rates.

Definitions: To be consistent with GSM vocabulary a call from the ALU to the GSM network is named "mobile originated call" or "outgoing call" and a call from the GSM network to an ALU is called "mobile terminated call" or "incoming call".

The GSM mobile unit which is installed in the vehicle or property and linked to the vehicle or property security system will be referred to as the Alarm Linked Unit (ALU) in order to distinguish it from other GSM mobile units which may be used in the utilization of the invention. Likewise the specific remote GSM mobile unit which is used to receive messages sent by the CELL-EYE and to communicate with the ALU will be referred to as the Remote Message Unit (RMU).

Automatic owner alerting function: The said CELL-EYE system is designed to automatically initiate an outgoing call to a preprogrammed RMU and indicate by means of a SMS message the nature of the disturbance. The message sent by the ALU is intended to alert the owner or security service provider of a criminal act perpetrated on the said vehicle or property and in the case of a vehicle to report to the owner or security service provider the location of the cellular mobile phone repeater station within whose immediate surroundings the ALU is located.

Remote activation: The controller of the said CELL-EYE system is designed to be activated by remote control via an incoming call carrying a coded Short Message Service (SMS) message. The said CELL-EYE system also allows the owner or security service provider to remotely activate a vehicle immobilization or protection system via the ALU.

Improvement in property-installed security systems: Low cost property-installed intrusion detection and alarms systems without an automatic dialling facility to a security service provider can be enhanced without the involvement of a dedicated security service provider though the addition of the said CELL-EYE system which can be programmed to contact the owner via the GSM cellular phone network and report to the owner the nature of the security violation. The owner can then, if necessary contact a security service provider or police department. Through its link to the GSM cellular phone system via a controller and memory unit the said CELL-EYE system also permits the remote activation or deactivation of alarms in the property protected by such a device.

Vehicle localization and tracking: The present invention provides also for a vehicle localization and tracking facility through an interface which relays the locality of the GSM cellular network repeater station nearest to the unattended GSM cellular mobile phone installed in a vehicle to the owner or security service provider by means of the GSM short message service (SMS). Thus the present invention provides a low cost alternative to satellite linked vehicle tracking systems by the use of the information available through the GSM network which indicates on any active mobile unit the location of the nearest GSM network repeater tower.

Remote immobilization and protection: The present invention also provides for a remote activation interface which links vehicle immobilization systems to the ALU installed in the vehicle. Such remote activation is an extension of existing systems which permit remote activation of a vehicle tracking transmitter installed in the vehicle. Furthermore, hijacked vehicles can be immobilized only when they are well away from an abandoned owner or driver thus reducing the likelihood of retaliation by the hijackers. The immobilization facility together with the localization and tracking facility provided by the CELL-EYE invention, promotes rapid recovery of a stolen vehicle.

Remote programming: A further advantage of the two-way communication between an owner and the protected which is possible with the present invention, is the facility which allows the owner to remotely

activate or program the security system by means of a telephone call from the owner's cellular phone to the CELL-EYE installed in the vehicle or property. Such programming could include periodic customization of the level of security appropriate for a particular situation and presetting alarm parameters such as the numbers that must be dialled when an alarm condition is detected, how frequently such calls need to be repeated and what to do if connection to a particular called number is not available at the time. Remote activation and programming of the device also alleviates the need for a user accessible interface to the CELL-EYE system.

Panic button function: If a panic button in the hijacked vehicle or in the protected property is depressed by an occupant, the said CELL-EYE system will automatically be activated and initiate an outgoing call and send a SMS message to a preprogrammed RMU which could be a number different from that used for mode 1 operation. The said RMU will display the number of the ALU that originated the call and then a SMS message will indicate that the call originated with the depression of a panic button. In the case of a vehicle installed CELL-EYE system, the system will then automatically go into mode 2 operation and indicate the location of the GSM repeater nearest to the ALU until by means of a SMS message on the RMU until the said CELL-EYE system is de-activated from a RMU by an incoming call to the ALU followed by a request and validation of the PIN code. The said automatic initiation of an outgoing call will be initiated without the CELL-EYE system having first been activated by means of an incoming call. This function of the said CELL-EYE system is intended to alert a friend or security service provider to take action to come to the aid of the person who depressed the panic button.

Identification of ALU originating the outgoing call: The said CELL-EYE system facilitates owner controlled handling of security violations in either vehicles or property through the messages received on his RMU. The ALU originating the outgoing call to the RMU is identified by means of the caller line identification feature which is available on most GSM cellular phone units. This feature will indicate to the owner or security service provider the cell-phone number of the ALU which originated the call and SMS message.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Without limiting the scope of the present invention an example of the invention will now be described with reference to the accompanying drawings in which:

- Figure 1 is a diagram depicting the environment in which the present invention is designed to operate.
- Figure 2 is block diagram of a preferred embodiment of the present invention. Figure 2 depicts the elements which comprise the CELL-EYE system incorporating an installed GSM mobile unit without keypad and with a linked modem. The arrows in the block diagram indicate the direction of information flow.
- Figure 3 is a block diagram depicting the elements which replace the modem in a CELL-EYE system incorporating an installed GSM mobile unit with keypad and without a linked modem, where the GSM mobile unit is linked to the controller and memory unit via electromechanical interfaces. The arrows in the block diagram indicate the direction of information flow.

A more complete understanding of the present invention may be derived by referring to the detailed description and claims when considered in connection with the FIGURES. In the accompanying FIGURES the same reference numbers refer to the same elements of the system throughout the FIGURES.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the accompanying drawing in Figure 1 the said CELL-EYE system is designed to operate in an environment where:

property 1 is a property which is equipped with a property security system and said CELL-EYE system installed near the controller or alarms of the property security system,

vehicle 2 is a vehicle which may, but need not include with a hidden vehicle security system which may include an alarm and a vehicle immobilization and protection system.

Said CELL-EYE system is installed in said vehicle, and said property or said vehicle are linked to a GSM

cellular mobile phone network with a multiplicity of GSM mobile network repeaters 3, where each cell is defined by the range of a particular repeater,

remote GSM cell-phone 4 (RMU) which may be in possession of the owner of said property or said vehicle, or in possession of a security service provider designated by the owner to monitor and respond to calls from said CELL-EYE system,

and said RMU is linked to said CELL-EYE system via the GSM mobile phone network represented by the repeater 3.

Referring to Figure 2, the preferred operation of the said CELL-EYE system is now described.

Remote activation: The CELL-EYE system can only be activated, de-activated or programmed via an incoming call to the ALU 16 and its associated modem. An activation call can be initiated from any hand-held GSM mobile unit. Upon reception of such an incoming call the controller will respond by initiating an SMS message requesting a PIN code to be entered. The CELL-EYE does not have a keypad to activate it or set any parameters. This ensures that the CELL-EYE can be hidden inside a vehicle and that any communication from a hand-held GSM cellular phone to the CELL-EYE is a secure communication conditioned on the use of two valid PIN codes, one for activating the hand-held GSM unit and the other for communicating to the unattended GSM mobile unit. The PIN code of the CELL-EYE is stored in non-volatile memory on the controller board. It can be changed only by providing the previous PIN code or a factory default PIN code. If the PIN code is entered incorrectly, the CELL-EYE sends up to two subsequent requests for the PIN code. If a valid PIN code is not entered upon the third trial, the CELL-EYE enters a locked mode which bars it from responding to any incoming calls for one hour.

Mode 1 operation: The remote alerting mode of operation (mode 1) of the said CELL-EYE system involve the following subsystems:

- a) the disturbance sensors 11,
- b) the vehicle or property security system 12,
- c) the alarm sensor interface 13,
- d) the panic button 17
- e) the controller and memory unit 14,
- f) the modem 15, and
- g) the installed GSM mobile unit 16 with an integral antenna.

Mode 2 operation: The said localization mode of operation (mode 2) of the said CELL-EYE system involve the following subsystems:

- a) the installed GSM mobile unit (ALU) 16
- b) the modem 15, and
- c) the controller and memory unit 14.

The mode 2 operation of the CELL-EYE system involves the following steps using the said subsystems:

- a) the installed CELL-EYE system receives an incoming call from a RMU,
- b) the identity of the caller is interrogated by the CELL-EYE returning a SMS message to the caller to indicate that a PIN code be entered,
- c) the caller enters a PIN code on the RMU which is received by the ALU and validated by the controller of the CELL-EYE system by comparison with a code stored the nonvolatile memory of its controller and memory unit.
- d) the CELL-EYE system returns a SMS message to indicate that the PIN has been validated,
- e) the operator using the RMU enters a code to activate mode 2 operation of the CELL-EYE system,
- f) the controller of the CELL-EYE system interrogates the ALU via the modem to determine the location of the nearest repeater as indicated by the GSM mobile phone network,
- g) the controller of the CELL-EYE system converts the returned location to the AT codes required for initiating a SMS message to the RMU via the modem and ALU
- h) steps f) and g) are repeated at preprogrammed intervals until the call is terminated by the RMU.

Mode 3 operation: The said remote immobilization and protection mode of operation (mode 3) of the said CELL-EYE system involve the following subsystems:

- a) the mounted GSM mobile unit 16
- b) the modem 15,

- c) the controller and memory unit 14,
- d) the vehicle immobilizer/protection interface 18, and
- e) the vehicle immobilizer/protection actuators 19

Communication devices: Communication to and from the CELL-EYE system to the user of the system is accomplished by means of a GSM mobile phone unit, the alarm linked unit 16, which is installed in the property or vehicle, together with a modem 15 which is designed to operate with the ALU.

Input devices: The CELL-EYE system is designed to be linked to input devices installed in the same property of vehicle namely the disturbance sensors 11 which form part of the vehicle or property security system 12 which has alarm outputs. The alarm outputs are detected and converted to digital form by the alarm sensor interface 13 which forms part of the CELL-EYE system. A panic button 17 installed in the property or vehicle provides a direct input to the controller and memory unit 14 of the CELL-EYE system.

Output devices: The CELL-EYE system is designed to be linked to output devices installed in the same vehicle namely vehicle immobilizer or protection actuators 19 which may form part of the vehicle security system 12 or may be separate elements. The vehicle immobilizer or protection actuators 19 are linked to the vehicle immobilizer or protection interface 18 which forms part of the CELL-EYE system. The vehicle immobilizer or protection interface 18 converts digital output signals from the controller and memory unit 14 to appropriate signals for activating the immobilizer or protection actuators.

Power supply elements: The power supply for the CELL-EYE system will be a rechargeable battery 20 with a standby lifetime of at least 48 hours. The said power supply will provide power for the following elements of the CELL-EYE system:

- a) the alarm sensor interface 13,
- b) the controller and memory unit 14,
- c) the modem 15,
- d) the alarm linked GSM mobile unit 16, and
- e) the vehicle immobilizer/protection interface 18.

The said battery 20 will be independent of the existing power supply or battery of the vehicle or property security system 12 and the power supply for the vehicle immobilizer/protection interface unit 18 so as to provide the facility for remote notification of the owner or security service provider of a power failure or disconnection of the vehicle battery. The said battery of the CELL-EYE system will be continuously charged from an external power source by means of a battery charging unit 21. In the case of a vehicle-installed CELL-EYE system the battery of the CELL-EYE system will be charged from the battery of the vehicle 22 using a battery charging unit 21. In the case of a property-mounted system the CELL-EYE system will be charged by means of the same battery charging unit 21 designed to be used in a vehicle-installed system, but with an additional external mains to 12 V DC converter 23.

Disturbance sensors 11: The disturbance sensors 11 and the vehicle or property security system 12 may be either be one of the following:

- a) part of an existing security installation in a vehicle or property,
- b) an external security system installed with the specific purpose of linking with the CELL-EYE system, or
- c) part of a security system integrated in the same enclosure with the other elements of the said CELL-EYE system.

The disturbance sensors 11 may include any appropriate sensors which could detect irregular or willful disturbance of the vehicle or property which may be associated with a criminal act, such as but not limited to the following:

- a) a micro switch or magnetically operated sensors which can detect the opening or attempted opening of a door or window, glove compartment or engine compartment of a vehicle,
- b) an accelerometer which can detect the movement of a vehicle or piece of property such as a safe,
- c) continuity sensors which can detect the breaking of a window,
- d) intrusion sensors operating by the interruption of an infrared light beam,
- e) infrared or ultrasonic sensors for detecting movement of a human body within a designated area,
- f) current loop sensors which can detect the interruption of power from either the mains or from a battery or detect the interruption of power to the telephone system which would occur if telephone wires are cut,
- g) a panic button linked to the vehicle or property security system,
- h) tampering sensors such as micro switches which can detect the attempted removal of the security system, the radio installed in the vehicle, the vehicle immobilizer, or the enclosure of the said CELL-

- EYE system,
- i) sensors indicating interruption of power to the security system 12 or a disconnection of the vehicle battery 22,
 - g) any other sensors intended to operate with the security system 12, or
 - j) any device expressly installed to detect an attempted intrusion or theft of the vehicle or property or anything within it, whether such sensors form part of a separate security system 12, or not..

The vehicle or property security system 12: The security system 12 should preferably be a system approved by the appropriate vehicle security system certification authorities and be installed by an qualified and approved installer. It is assumed that except for the case of the depression of a panic button, the security system 12 will for its normal operation be activated after an appropriate code has been entered on a keypad or after a button on a coded remote activation transmitter has been pressed to transmit an activation signal to a receiver which forms part of the said security system. For security systems installed in buildings, the said system is assumed to provide for a sufficient delay time for the user to leave the building before it becomes active.

Panic button 17: The panic button 17 may be a normally open switch mounted in an accessible place in the vehicle or property where said panic button is connected directly to the controller and memory unit of said CELL-EYE system in order to permit automatic activation of the said CELL-EYE system by an occupant of the vehicle or property. Said panic button may also be such a switch which forms part of an installed security system which is also directly connected to the CELL-EYE system.

Alarm sensor interface 13: The alarm sensor interface 13 forms part of said CELL-EYE system and is a subsystem which detects any relevant output from the vehicle or property security system 12 where such output is specifically activated in response to the detection of irregular or willful disturbance of the vehicle or property. Such output may include but should not be limited to the following:

- a) the switching on of indicator lights on the security system,
- b) the switching on or flashing of vehicle or property lights,
- c) the application of power to a siren or audible alarm,
- d) the production of sound by means of a siren or audible alarm, or
- e) the initiation of a telephone call to a security service provider from a property-installed security system.

The alarm sensor interface 13 which forms part of the said CELL-EYE system is intended to convert such an output from the vehicle or property security system 12 to a digital electronic signal compatible with required inputs of the controller and memory unit 14. The alarm sensor interface 13 contains circuits to perform the following functions:

- a) a time and frequency filtering function to minimise the likelihood of its activation by extraneous signals not related specifically to the output of security system 12,
- b) a latching function to keep its output signals in the active state even after termination of the alarm indicating outputs of the security system 12,
- c) a reset function which resets the output signals of the alarm sensor interface after the reception of digital inputs from the ALU 16 via the modem 15 and the controller and memory unit 14.

Controller and memory unit 14: The controller and memory unit 14 which form part of the said CELL-EYE system is intended to control the operation of the CELL-EYE system through the interpretation of incoming calls, the automatic initiation of outgoing calls, the processing of DATA it receives from either the alarm sensor interface 13 or the ALU, and the activation of the vehicle immobilizer/ protection interface 18. The controller and memory unit 14 comprises a micro controller with nonvolatile memory and associated digital circuits and software to perform the following functions:

- a) generate the AT commands implemented by the GSM SMS message service for initiating outgoing calls from the ALU to the RMU via the modem,
- b) interpret the AT control commands received from the RMU via the modem and ALU,
- c) respond to incoming calls by first generating the AT commands required for requesting a PIN code from the RMU,
- d) compare a PIN code received from the RMU with the code stored in memory and generates the AT commands to send a confirmation message to the RMU if the PIN code is accepted,
- e) provide a disarming period during which the CELL-EYE system is de-activated for a preprogrammed duration if the programmed maximum duration between the reception of a first incoming call and the provision of a valid PIN code has expired,
- f) provide a disarming period during which the CELL-EYE system is de-activated for a preprogrammed duration in case a valid PIN code is not received in three trials,

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- g) responds to messages received by the ALU in an appropriate way such as updating the PIN code stored in memory, updating the phone number to be used for automatic notification of a security violation, updating the phone number to be used in response to a panic button depression, activation or de-activation of the automatic call function, activation or de-activation of the vehicle localization function,
 - h) generate signals to activate a vehicle immobilizing or protection system,
 - i) automatically initiates an outgoing call to a preprogrammed RMU when any of outputs of the alarm sensor interface are set,
 - j) generate the SMS codes to indicate to a preprogrammed RMU the nature of the alarm which initiated the call,
 - k) automatically initiate an outgoing call to another preprogrammed RMU in response to a depression of the panic button 17 and generate the SMS codes to indicate that the call was originated by the depression of a panic button,
 - l) automatically interrogate the ALU for the location of the nearest GSM repeater if the vehicle localization function is activated,
 - m) convert the location of the nearest GSM repeater station as supplied through the GSM network to the ALU to a SMS message which is sent to the designated RMU at regular intervals,
 - n) activates the vehicle immobilizer/protection interface 18 if a validated request for such activation is received from a RMU, and
 - o) any other functions which are required for the implementation of the intended functions of the CELL-EYE system.

The controller unit of the CELL-EYE system will contain firmware in non-volatile memory for the handling of the SOFT-ON power up feature when power is connected to the ALU and modem. The same firmware will ensure that the ALU module does not power itself off or cause itself to be powered off by the SOFT-ON circuitry operating inadvertently, due to power fluctuations.

Modem 15: The modem 15 is a GSM modem integrated with the GSM mobile unit 16 to facilitate data communication between the controller and memory unit 14 and the GSM mobile unit 16. In one embodiment of the CELL-EYE system this modem forms part of an integrated GSM module and modem. The data communication mode is asynchronous mode serial communication at up to 9600 bit/s. The modem is designed to interpret the commands sent to the said modem by the controller for the purpose of activating various functions of the GSM mobile unit 16 and to convert data inputs from the GSM mobile unit 16 to the codes which can be interpreted by the controller and memory unit 14.

Alarm linked GSM mobile unit 16: The alarm linked GSM mobile unit 16 (ALU) is preferably a GSM mobile unit without keypad. It may be but is not limited to being a FALCOM A2 GSM mobile unit with modem. This unit is a fully type approved cellular phone. It has the facility for an internal or external SIM card. In the preferred embodiment the external SIM card reader, if used, is to be placed in a hidden but accessible part of the vehicle or property for example in a locked compartment. The external SIM card reader will be connected to the GSM mobile unit by means of a cable and a 6-pin connector. In a building-installed system the internal SIM card option may be used. The GSM mobile unit will be configured for voiceless DATA and SMS mode operation.

Vehicle immobilizer/protection system interface 18 and vehicle immobilizer/protection actuators 19: The vehicle immobilizer/protection interface 18 comprises circuits for converting the digital output signals from the controller/memory unit 14 to signals for electrically activating external immobilizer/protection actuators 19 in the vehicle or the actuators of an immobilizer/protection system integrated with the CELL-EYE system. Immobilization or protection of the vehicle may be achieved by one or more of the following means:

- a) interruption of the current to the starter solenoid of the vehicle via an electrically activated switch which activates a normally closed relay that interrupts the power to the starter solenoid or starter motor whenever there would be an attempt to start the vehicle by means of the ignition switch,
- b) interruption of current to the ignition system of the vehicle via an electrically activated switch which supplies current to a normally closed relay,
- c) interruption of the fuel flow to the engine system via an electrically operated switch which supplies current to an electrically operated fuel valve which is normally closed,
- d) activation of an electrically operated brake or wheel locking system,
- e) activation of an electrical lock which prevents the engine compartment of the vehicle from being opened to gain access to the vehicle battery 22 or to override other immobilization systems 19.

DETAILED DESCRIPTION OF THE EMBODIMENT OF THE SYSTEM INCORPORATING ELECTROMECHANICAL INTERFACES

Referring to the accompanying drawing in Figure 3 the following preferred embodiment is used for implementation of the CELL-EYE system with a standard GSM handheld cell-phone with keypad and silent ringer (vibrator) which is used as an ALU in stead of a dedicated GSM mobile unit without keypad but with modem as described above:

Electromechanical dialling interface 24: One embodiment of the link between the controller and memory unit 14 and the standard GSM cell-phone with integral keypad used for this embodiment, comprises an electromechanical dialling device linked with the controller and memory unit. The objective of the mechanical dialling system is to dial a preprogrammed number on the ALU through controlled electromechanical depression of the keys on the keypad of a standard cell-phone inserted into a hidden container.

The said electromechanical dialling device 24 consists of a set of plunger-type solenoids arranged on a backing plate in an array matching the location of the keys on the keypad of a particular GSM handheld cell-phone which is inserted in an enclosure equipped with the mechanical interface. The said backing plate forms a hinged side of the enclosure designed to hold a standard GSM cell-phone in position for unattended operation. When the hinged side is closed, the backing plate is positioned with the solenoids just touching the keys of the ALU. The direction of movement of the solenoid plungers is perpendicular to the backing plate.

When energized by the controller, the solenoids of said electromechanical device move in such a way as to depress the corresponding keys on the keypad of the cell-phone. The solenoids are energised by digital output of the controller unit 14 via transistor current amplifiers. For this embodiment the controller is programmed to energize the solenoids in such a way as to initiate transmission of an outgoing call and a GSM SMS message to the owner's RMU. The owner will receive an indication of the origin of the call by means of the caller line identification message which is available on the GSM network on any GSM mobile phone configured for displaying such a message. The corresponding SMS message is coded to indicate to the owner the nature of the irregular or willful disturbance of the vehicle or property.

The electromechanical system will repeatedly dial the said SMS message to the owner at preset intervals ranging from 5 minutes to 30 minutes until the battery of the cell-phone is drained, or the call is terminated by the remote RMU or the system is de-activated by removal of the cell-phone from the enclosure.

The silent ringer detector 25: One embodiment of the link between the ALU and the controller and memory unit of the said CELL-EYE system comprises a circuit for the electromechanical detection of an incoming call on an installed ALU equipped with a silent ringer. The silent ringer comprises a vibrating element designed to alert the user of such a GSM mobile unit of an incoming call. In the present embodiment of the CELL-EYE system the vibrator movement indicating an incoming call is detected by means of an integrated circuit accelerometer mounted in the housing for the GSM mobile unit in close proximity to the ringer.

The accelerometer output is processed by a filter circuit which responds only to the vibration frequency of the ringer and not to vehicle vibrations. The output of the filter circuit provides a digital signal which is interpreted by the controller and memory unit to activates an external immobilization system or an integrated vehicle immobilization system via the vehicle/protection interface 18 of the said CELL-EYE system.

In summary, the present invention provides for interfaces between conventional alarm systems and an installed GSM cellular phone to facilitate:

- a) the reporting of security violations via automatic calls directing coded SMS messages to a remotely located GSM mobile phone equipped with SMS service,
- b) the provision of information on the locality of the unattended GSM mobile phone to a remote GSM cellular phone via the SMS service,
- c) the activation and programming of the installed GSM mobile unit by means of DATA messages sent from a remote GSM cellular phone, and
- d) the activation of vehicle immobilization systems via DATA messages received by the installed GSM

mobile unit from a remote GSM mobile phone or via the detection of an incoming call to the installed GSM cellular phone via a silent ringer detector.

The present invention has been described with reference to preferred embodiments. However, those skilled in the art may recognise that changes may be made in this preferred embodiment without departing from the scope of the present invention. It is foreseen that the present invention may be adapted to incorporate additional capabilities and features that may become available. Such additional features may include the further processing of data passed between the remote GSM mobile unit and the unattended GSM mobile unit installed in the vehicle or property to achieve various desired levels of security and desired false alarm rates. Those skilled in the art will recognise that the specific tasks and procedures described herein in connection with the preferred embodiment may be altered significantly without departing from the scope of the present invention. These and other changes and modifications which are obvious to those skilled in the art are intended to be included within the scope of the present invention.

CLAIMS

1. A security system called a CELL-EYE system is disclosed which operates with GSM digital mobile communication devices for protecting specific property, human life and for the prevention of vehicle-theft and irregular and willful intrusion of property through

the detection and reporting of alarm outputs of vehicle or property security systems by an unattended device;

the notification of a remote person or security service provider of the depression of a panic button in a vehicle or building;

the localization and tracking of a vehicle; and

the remote activation of a vehicle immobilization system.

Said CELL-EYE system comprises:

a GSM mobile unit installed in a vehicle or property

a modem linked to said GSM mobile unit for the reception and transmission of DATA and SMS messages via the GSM mobile network;

a vehicle or property security system having an electronic or audible output signal which is activated to indicate an irregular and willful attempt of vehicle theft or intrusion of property

an alarm sensor interface linked to the alarms of a vehicle or property security system;

a panic button which is to be mounted in a hidden but accessible location in a vehicle or in an appropriate location in a building or property

a vehicle immobilizer and protection interface linked to a vehicle immobilizer system;

a controller and memory unit coupled to said modem and via the modem coupled to said GSM mobile unit, and coupled to said alarm sensor interface, to said panic button and to said vehicle immobilization interface;

a rechargeable battery to provide power to all the elements of the CELL-EYE system, excluding the said vehicle or property security system or the vehicle immobilization and protection actuators;

a battery charging unit for charging said rechargeable battery from an external 12 V battery or AC mains power to 12 V DC converter

an AC mains power to 12 V DC converter to provide power for said battery charging unit for property-installed CELL-EYE systems

data control means for responding to user input through incoming calls with data received via said installed GSM mobile unit, for initiating a message exchange with the originator of an incoming call to request the entering of a PIN code and to confirm the validity of the received PIN code, for changing the PIN code stored in the memory unit in response to a validated incoming call requesting such change of PIN code, for changing the stored numbers to which outgoing calls should be made in response to certain alarm conditions, for changing the stored parameters for unattended operation of the CELL-EYE system, for responding to an alarm condition indicated by said alarm sensor interface by initiating outgoing calls to send data and SMS messages to a stored number or numbers via the modem to said installed GSM mobile unit, for responding to the depression of said panic button by initiating outgoing calls to send SMS messages to a preprogrammed stored number or numbers via said installed GSM mobile unit, and for activating said vehicle immobilizer and protection interface in response to a validated incoming call with data specifically requesting such immobilization;

memory means for storing programmed procedures, codes and data retrieved from incoming calls communicated to said memory means via the said installed GSM mobile unit, modem and controller,

and for records of the status of alarm systems;

timing control means for determining the duration between repeated requests for a valid PIN code, the duration of a disarming and deactivation period of the CELL-EYE system after reception of an invalid PIN code, the duration between repeated calls to stored numbers, the duration of intervals between the activation of vehicle immobilizer systems, the duration of time over which a vehicle fuel starvation actuator is closed and any other timing function required for the intended operation of the CELL-EYE system. The parameters of the timing control means can be set via the said controller by incoming data carrying calls to the CELL-EYE GSM mobile unit and modem;

alarm sensing means implemented in the said alarm sensor interface for converting the audible or electronic alarm outputs of said vehicle or property security system to a digital signal compatible with the said controller;

2. A security system operating with GSM digital mobile communication devices as claimed in claim 1 wherein said user input to and remote programming of the CELL-EYE system can be achieved via an incoming call from another remote GSM mobile unit. Only after the provision of a valid PIN code will the installed GSM mobile unit permit the user to activate or deactivate the said CELL-EYE system or change any of the stored numbers, codes or parameters of the system.
3. A security system operating with GSM digital mobile communication devices as claimed in claim 1 additionally comprising

message control means forming part of said controller and memory unit and coupled to said remote programming means and alarm sensing means for transmitting to a remote GSM mobile unit SMS messages defined by said alarm parameters corresponding to specific alarm conditions. The messages are recorded and stored in the memory unit by said remote programming control means. Coupled to said message control means are means for encoding the outputs of said alarm sensor interface as SMS messages.

4. A means of effecting outgoing calls on a security system which uses conventional GSM digital mobile communication devices which are not equipped with an integral modem but do have a keypad for receiving user input comprising:

an electromechanical interface consisting of a set of plunger-type solenoids arranged on a backing plate in an array matching the location of the buttons of a particular GSM handheld mobile unit which is inserted in the rigid plastic housing for the mechanical interface;

a driver circuit for converting digital signals from the controller unit to suitable power levels for activating the said plunger-type solenoids for duration of time sufficient to effect a depression of the corresponding key on the keypad of the said mounted GSM mobile unit; and

a message control means for converting the programmed codes, numbers and messages to a set of signal for the sequential activation of the set of solenoids in said electromechanical interface in order to initiate an outgoing call in response to an alarm condition indicated by said alarm sensor interface.

5. A means of effecting activation of a vehicle immobilizer or protection actuator with a security system which uses conventional GSM digital mobile communication devices which are not equipped with an integral modem but do have a silent ringer for alerting the user to an incoming call. The said means of implementing the said vehicle immobilizer or protection interface comprises:

an integrated circuit accelerometer mounted in the rigid plastic housing for the GSM mobile unit in close proximity to the silent ringer of said GSM mobile unit;

a filter circuit which responds to the vibration frequency of the silent ringer and not to vehicle vibrations;

a latching circuit which is activated by the output of the said filter circuit to provide an output to the said vehicle immobilizer or protection actuators. Said latching circuit can be reset by the depression of a hidden reset button on the housing for the said mounted GSM mobile unit equipped with silent ringer or by removal of the said GSM mobile unit.

FIGURES

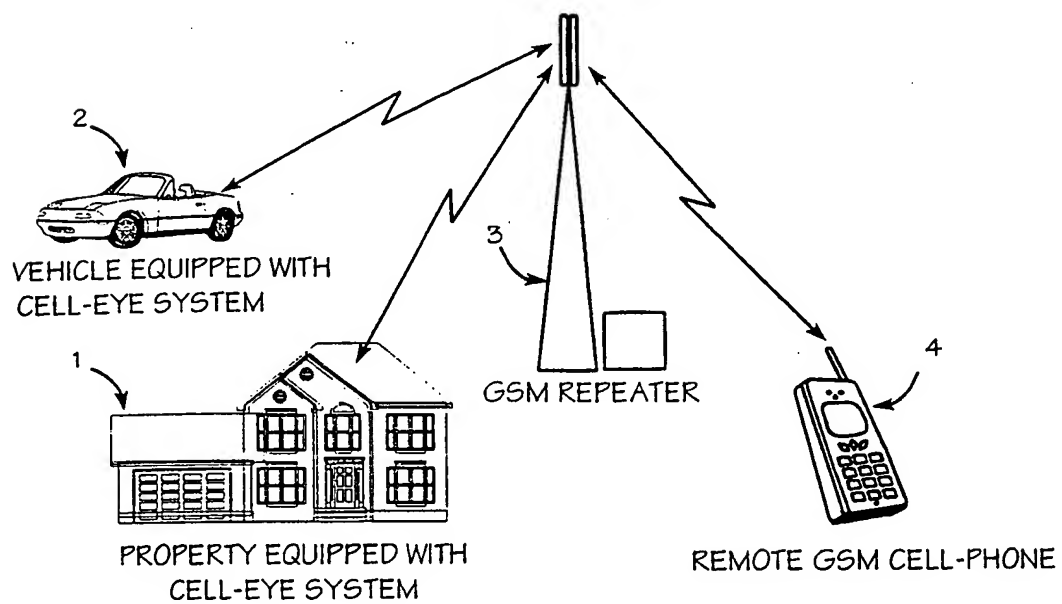


FIGURE 1

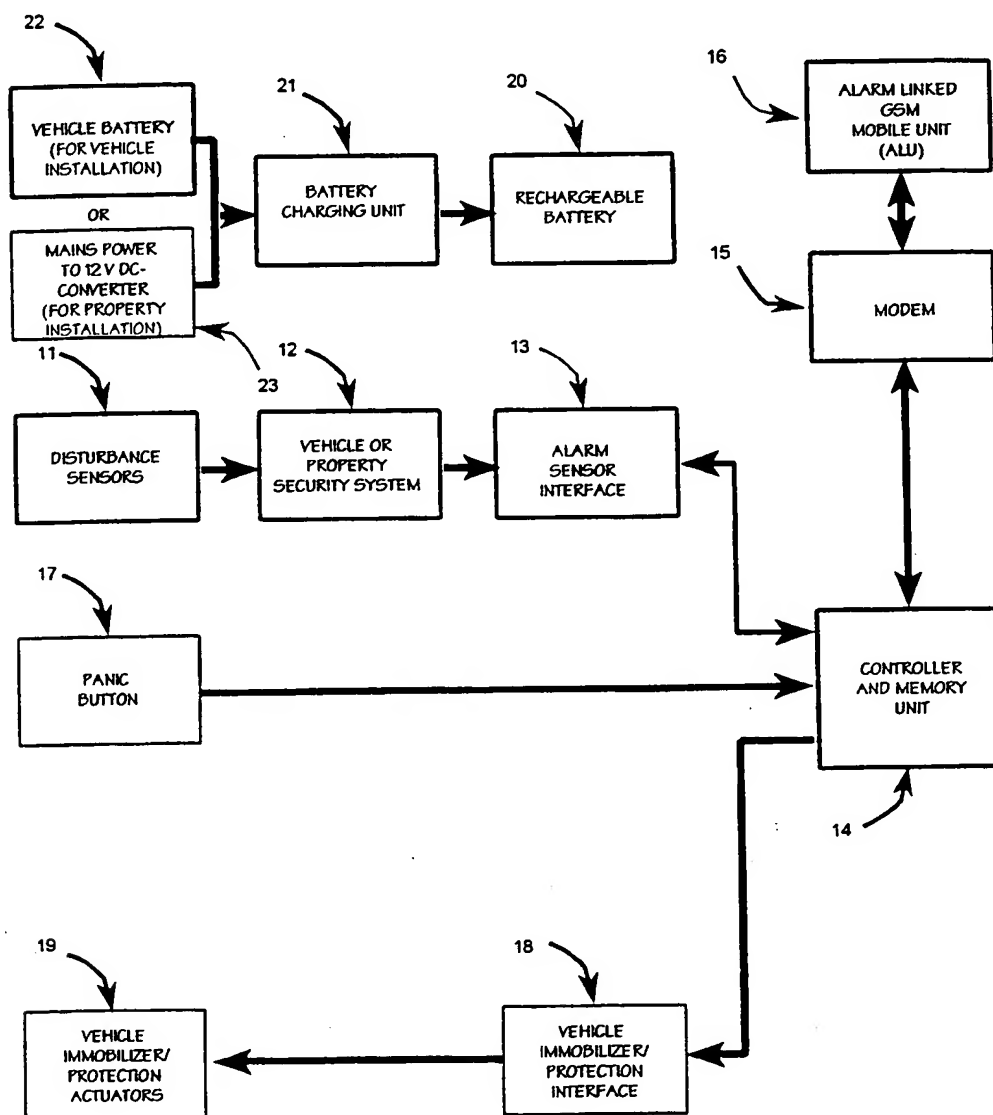
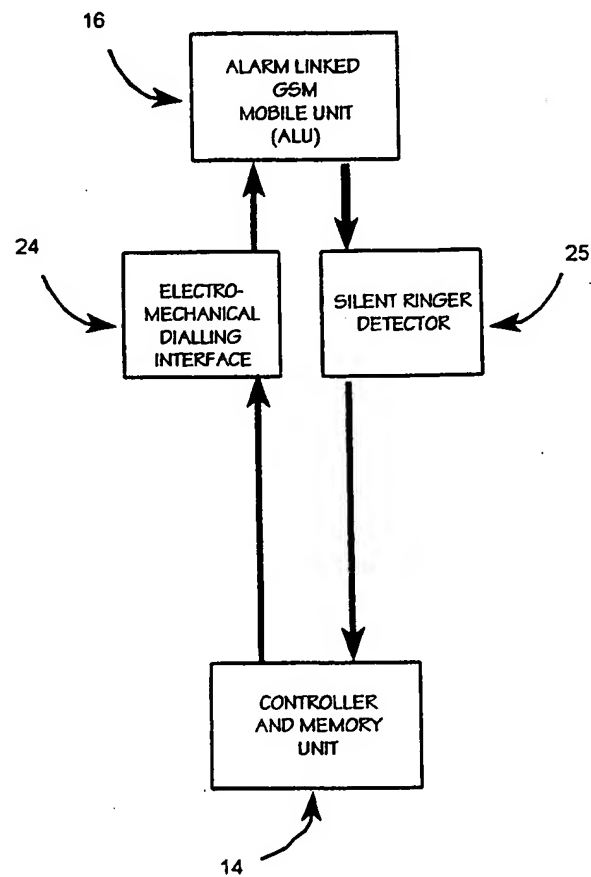


FIGURE 2

**FIGURE 3**

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ZA 99/00092

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60R25/04 B60R25/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 748 727 A (SEGURMAP SA) 18 December 1996 (1996-12-18) column 2, line 43 -column 4, line 6 column 7, line 29 -column 8, line 17; figures ---	1,4
A	WO 98 01769 A (LANDI GIULIANO) 15 January 1998 (1998-01-15) page 4, line 4 -page 5, line 10; claims 1,2; figures ---	1,4
A	WO 96 38996 A (BUYTAERT STEVEN HERWIG CYRIEL ; MAES MARC JOSEF MARIA (BE); ORENS G) 5 December 1996 (1996-12-05) page 17, line 17 -page 19, line 15; figures --- -/--	1,4

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

*** Special categories of cited documents**

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

1 February 2000

Date of mailing of the international search report

09/02/2000

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/ZA 99/00092

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 45822 A (LEO WILLIAM BLAIN ;MARTELLI DANIEL PETER (AU); DAIBER ROLF OTTO (A) 4 December 1997 (1997-12-04) claims 2,15 -----	1,5
A	WO 98 24664 A (WALKER RICHARD C) 11 June 1998 (1998-06-11) page 13, line 2 -page 15, line 5 page 21, line 16 -page 22, line 8 -----	1,5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ZA 99/00092

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. claims 1-3: alarm and immobiliser with a GSM cellular phone
2. claim 4: means for effecting outgoing calls
3. claim 5: means for effecting activation of a vehicle immobiliser

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims: it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/ZA 99/00092

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